

REMARKS

Applicant respectfully requests reconsideration of this application as amended. Claims 1-3, 5-16, 18-21, 23-75 remain in this application. Claims 1, 7, 14, 18, 43, 50, 57, and 64 have been amended. Claims 4, 17, and 22 have been canceled. No new claims have been added.

Rejections under 35 U.S.C. § 102(b)

The Office Action rejected claims 43-46 and under 35 U.S.C. § 102(a) as being anticipated by Jukan et al., “Constraint-based Path Selection Methods for On-demand Provisioning in WDM Networks” (hereinafter “Jukan”).

Jukan describes “decentralized, on-demand provisioning in fully or partially electronically regenerative, constraint-based routed, multi-service WDM networks.” (Jukan, Page 828, Right column.) “Based on [] local state information a choice among different feasible paths is made at destination, according to service-level agreements and optical network operation objectives.” (Jukan, Page 829, Left column.) Jukan is “an adaptation of the label-correcting shortest path algorithms, which use flooding of the connection set-up messages from source to destination. The messages are updated based on the local network state information at each traversed network element, and converge in a set of feasible paths by discarding invalid paths towards destination.” (Jukan, Page 831, Right Column.) Accordingly, a node in Jukan only has knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links.

With respect to claim 43, Jukan does not describe “receiving a request for a communication path starting at a source node in an wavelength division multiplexing optical network; selecting a first of a plurality of service levels, wherein different wavelengths on at least certain links of said optical network qualifying for different ones of said plurality of service levels forms a different service level topology for each of said

plurality of service levels for each access node of said optical network; selecting a path and a wavelength on said path using a database that stores, for each of the plurality of service levels, a representation of every available path from the source node to other access nodes in said optical network, wherein each path is a series of two or more nodes connected by links having a set of one or more wavelengths at the same service level; and causing allocation of the selected wavelength in the series of nodes of the selected path.” A node in Jukan only has knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links, but does not have a service level topology structure.

Accordingly, the combination of Golmie and Acharya does not describe what Applicants require in claim 43. Claims 44-47 are dependent upon claim 43 and are therefore allowable for at least the same reason.

Rejections under 35 U.S.C. § 103(a)

The Office Action rejected claims 1-4 and 14 under 35 U.S.C. § 103(a) as being unpatentable over Golmie et al., “A Differentiated Optical Services Model for WDM Networks” (hereinafter “Golmie”) in view of Acharya et al., US Patent Application Publication No. 2004/0228323 (hereinafter “Acharya”).

Golmie describes “a QoS service model in the optical domain ... based on a set of optical parameters that captures the quality and reliability of the optical lightpath.” (Golmie, Abstract and Table 1.) An optical lightpath being “an optical communication channel, traversing one or more optical links, between a source-destination pair.” (Golmie, Page 69, Left column.) Golmie classifies lightpaths (not wavelengths or paths) based on QoS and these classes for example “consist[] of three alternate lightpaths between a single source-destination pair accessible at the WADM, each with a unique DoS class, labeled class 1, class 2, and class 3, containing wavelength groups (λ_1, λ_2), (λ_3, λ_4), and (λ_5, λ_6) respectively... All lightpaths in a DoS class have equivalent quality of optical service between a source-destination pair.” (Golmie, page 72, Left column.)

Golmie does not describe determining service level topologies. (See Office Action, page 3.) Golmie does not describe what type of databases are used, the content of these databases, or where a network topology database may be stored.

Acharya describes “a maximum-flow based route precomputation algorithm [that] includes at least a route generation phase and a route selection phase.” (Acharya, Abstract.) “[E]ach materialized route is stored along with the permissible bandwidth that can be routed along the route.” (Acharya, Paragraph 0040.) Acharya assumes “that a reasonably up-to-date network topology is available at route computation time.” (Acharya, Paragraph 0029.) “This information may be obtainable in certain applications from routing protocols such as OSPF-TE.” (Acharya, Paragraph 0029.)

With respect to claim 1, the combination of Golmie and Acharya does not describe “applying a set of one or more connectivity constraints that include quality of service (QoS) based criteria on a physical network topology of a wave length division multiplexing optical network to divide said optical network into separate service levels; and determining service level topologies for each of said service levels for each node in the optical network.” Applicants’ “service level node connectivity divides the optical network into QoS based logical network views...Thus, for a first access node there are one or more paths across physical links to a second access node (physical topology). For any given one of these paths, there may be, on each of the link(s) making up that path, wavelengths at the same service level. For any given one of these paths, there may also be, on the link(s) making up that path, one or more of the same wavelengths at the same service level.” (Applicants’ Paragraph 0062.) Rather, the combination of Golmie and Acharya describes a QoS service model based on a set of optical parameters that captures the quality and reliability of a lightpath, uses OSPF-TE to determine physical network topologies for the entire system, and each node uses the same database about the physical network topology.

Accordingly, the combination of Golmie and Acharya does not describe what Applicants require in claim 1. Claims 2-3 and 5-6 are dependent upon claim 1 and are therefore allowable for at least the same reason.

With respect to claim 14, the combination of Golmie and Acharya does not describe “a wavelength division multiplexing optical network supporting a plurality of service levels, wherein different wavelengths on at least certain links of said optical network qualify for different ones of said plurality of service levels; and at least one separate network topology database for each of said plurality of service levels that represents the connectivity between nodes of said optical network using those of the wavelengths that qualify for that service level, wherein each access node of said optical network stores a separate one of said network topology databases for each of said plurality of service levels.” Rather, the combination of Golmie and Acharya describes a QoS service model based on a set of optical parameters that captures the quality and reliability of a lightpath, uses OSPF-TE to determine physical network topologies for the entire system, and each node uses the same database about the physical network topology.

Accordingly, the combination of Golmie and Acharya does not describe what Applicants require in claim 14. Claims 15-16 are dependent upon claim 14 and are therefore allowable for at least the same reason.

The Office Action rejected claims 7-9 under 35 U.S.C. § 103(a) as being unpatentable over Golmie in view of Kodialam et al., US Patent Application Publication No. 2002/0018264 (hereinafter “Kodialam”). The combination of Golmie and Kodialam does not describe what Applicants are claiming.

Kodialam describes “dynamic routing (IDR) of service level (e.g., bandwidth) guaranteed paths for network tunnel paths...” (Kodialam, Abstract.) “IDR determines whether to route an arriving request for a network tunnel path over the existing topology or to open a new, available optical wavelength path.” (Kodialam, Abstract.) “[E]ach LSP [label switched path] determined route is computed at the local ingress router without communication with a domain or area wide router-server in communication with

all routers of the nodes in the network....In employing OSPF and its extension, the topology information may be derived from the link state database, with residual capacities derived using messaging and signaling methods...” (Kodialam, Paragraph 0041.) The network of Kodialam may have OXCs with or without wavelength conversion capability. (Kodialam, Paragraphs 0045-0046.) It does not relate this concept to a service level.

With respect to claim 7, the combination of Golmie and Kodialam does not describe “maintaining in each node of a wave length division multiplexing optical network a classification by QoS criteria of wavelengths for each link of the wave length division multiplexing optical network, said QoS criteria defining a plurality of service levels; and for each of said plurality of service levels, maintaining service level connectivity from each node to other nodes of the wave length division multiplexing optical network based on a conversion criteria.” Rather, the combination of Golmie and Kodialam describes a QoS service model based on a set of optical parameters that captures the quality and reliability of a lightpath, uses OSPF-TE to determine physical network topologies for the entire system, and each node uses the same database about the physical network topology.

Accordingly, the combination of Golmie and Kodialam does not describe what Applicants require in claim 7. Claims 8-13 are dependent upon claim 7 and are therefore allowable for at least the same reason.

The Office Action rejected claims 18-20, 22, 24-25, 31-32, and 34 under 35 U.S.C. § 103(a) as being unpatentable over Golmie in view of Sengupta et al., “Analysis of Enhanced OSPF for Routing Lightpaths in Optical Mesh Networks” (hereinafter “Sengupta”).

Sengupta describes “enhancements to the OSPF protocol for routing and topology discovery in optical mesh networks.” (Sengupta, Abstract.) “OSPF allows hierarchical routing, whereby a large network may be treated as a collection of smaller areas with

limited information exchange between areas.” (Sengupta, Page 2865, Right column.)

“[R]oute computation is triggered by path setup requests only... [with the] need to run the path computation algorithm at an ingress OXC only when the lightpath request arrives.” (Sengupta, Page 2866, Right column.) It is Applicants’ understanding that in this system each node of an area has the same database that contains information about the all of the nodes of entire area and is not specific to just that particular node; route calculation is only responsive to a lightpath request and no forwarding table is computed. (Sengupta, Page 2866, Right column, bullet 4.)

The combination of Sengupta and Golmie is a QoS service model based on a set of optical parameters that captures the quality and reliability of an optical lightpath (not paths and wavelengths) and uses OSPF to determine physical network topologies for the entire system. In this model, each node of an area has the same database that contains information about the all of the nodes of entire area and is not specific to just that particular node. This database information would include information about lightpaths separated by class for the entire area and would not be specific to a particular access node.

The combination does not describe what Applicants’ claim 18 requires. Specifically, it does not describe “for each wavelength on each link of a wavelength division multiplexing optical network, a wavelength parameter for each of a set of QoS based criteria; for each of a plurality of service levels, a service level parameter for each of said set of QoS based criteria; for each link of said optical network, a link service level channel set for each of said plurality of service levels representing those of the wavelengths on that link with parameters meeting the service level parameters of that service level; and for each access node of said optical network, a service level topology structure for each of said plurality of service levels representing connectivity of that access node to others of said access nodes using wavelengths from the link service level

channel sets of that service level, wherein each access node stores those of said service level topology structures representing connectivity of that access node.”

Accordingly, the combination of Golmie and Sengupta does not describe what Applicants require in claim 18. Claims 19-21 and 23 are dependent upon claim 18 and are therefore allowable for at least the same reason.

With respect to claim 24, the combination of Golmie and Sengupta does not describe what Applicant’ claim requires. The combination of Sengupta and Golmie is a QoS service model based on a set of optical parameters that captures the quality and reliability of an optical lightpath (not paths and wavelengths) and uses OSPF to determine physical network topologies for the entire system. In this model, each node of an area has the same database that contains information about the all of the nodes of entire area and is not specific to just that particular node. This database information would include information about lightpaths separated by class for the entire area and would not be specific to a particular access node.

The combination does not describe “an access node, to be coupled in a wavelength division multiplexing optical network, including, a link state database to store, for each link connected to said access node, a link state structure to store a port of the access node to which that link is connected, available wavelengths on that link, and parameters of those wavelengths; a service level parameter database to store, for each of a set of one or more supported service levels, a service level parameter for each of a set of QoS based criteria; and a service level connectivity database to store, for each of said set of service levels, a service level topology structure that stores a representation of the service level topology of that service level for said access node.”

Accordingly, the combination of Golmie and Sengupta does not describe what Applicants require in claim 24. Claims 25-30 are dependent upon claim 24 and are therefore allowable for at least the same reason.

With respect to claim 31, the combination of Golmie and Sengupta does not describe what Applicants' claim requires. The combination of Sengupta and Golmie is a QoS service model based on a set of optical parameters that captures the quality and reliability of an optical lightpath (not paths and wavelengths) and uses OSPF to determine physical network topologies for the entire system. In this model, each node of an area has the same database that contains information about the all of the nodes of entire area and is not specific to just that particular node. This database information would include information about lightpaths separated by class for the entire area and would not be specific to a particular access node.

The combination does not describe "for each link to an adjacent node of said wavelength division multiplexing optical network, said access node classifying wavelengths on that link according to a set of one or more service level parameters for each of a plurality of service levels; for each of said plurality of service levels, instantiate a service level topology structure; and responsive to receiving information regarding connectivity at each of said plurality of service levels to other access nodes in said optical network, adding such information to said service level topology structure for that service level."

Accordingly, the combination of Golmie and Sengupta does not describe what Applicants require in claim 31. Claims 32-36 are dependent upon claim 31 and are therefore allowable for at least the same reason.

The Office Action rejected claims 37-38 and 40 under 35 U.S.C. § 103(a) as being unpatentable over Golmie and Sengupta as applied to claims 18-20, 22, 24-25, 31-32, and 34, and further in view of Freeman, "Telecommunication System Engineering" (hereinafter "Freeman"). Freeman describes to store method steps as program memory for providing instructions to a controller or computer.

With respect to claim 37, the combination of Golmie, Sengupta, and Freeman does not describe what Applicants are claiming. The combination of Sengupta and Golmie is a QoS service model based on a set of optical parameters that captures the quality and reliability of an optical lightpath (not paths and wavelengths) and uses OSPF to determine physical network topologies for the entire system. In this model, each node of an area has the same database that contains information about the all of the nodes of entire area and is not specific to just that particular node. This database information would include information about lightpaths separated by class for the entire area and would not be specific to a particular access node.

The combination does not describe “for each link to an adjacent node of said wavelength division multiplexing optical network, said access node classifying wavelengths on that link according to a set of one or more service level parameters for each of a plurality of service levels; for each of said plurality of service levels, instantiate a service level topology structure; and responsive to receiving information regarding connectivity at each of said plurality of service levels to other access nodes in said optical network, adding such information to said service level topology structure for that service level.”

Accordingly, the combination of Golmie and Sengupta does not describe what Applicants require in claim 37. Claims 38-42 are dependent upon claim 37 and are therefore allowable for at least the same reason.

The Office Action rejected claims 50-53 under 35 U.S.C. § 103(a) as being unpatentable over Jukan in view of Freeman.

Jukan describes “decentralized, on-demand provisioning in fully or partially electronically regenerative, constraint-based routed, multi-service WDM networks.” (Jukan, Page 828, Right column.) “Based on [] local state information a choice among different feasible paths is made at destination, according to service-level agreements and

optical network operation objectives.” (Jukan, Page 829, Left column.) Jukan is “an adaptation of the label-correcting shortest path algorithms, which use flooding of the connection set-up messages from source to destination. The messages are updated based on the local network state information at each traversed network element, and converge in a set of feasible paths by discarding invalid paths towards destination.” (Jukan, Page 831, Right Column.) Accordingly, a node in Jukan only has knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links.

The combination of Jukan and Freeman does not describe “responsive to receiving a request for a communication path starting at a source node in an wavelength division multiplexing optical network, selecting a first of a plurality of service levels, wherein different wavelengths on at least certain links of said optical network qualifying for different ones of said plurality of service levels forms a different service level topology for each of said plurality of service levels for each access node of said optical network; selecting a path and a wavelength on said path using a database that stores, for each of the plurality of service levels, a representation of every available path from the source node to other access nodes in said optical network, wherein each path is a series of two or more nodes connected by links having a set of one or more wavelengths at the same service level; and causing allocation of the selected wavelength in the series of nodes of the selected path.” Rather, the combination describes a node that only has only knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links.

Accordingly, the combination of Jukan and Freeman does not describe what Applicants require in claim 50. Claims 51-56 are dependent upon claim 50 and are therefore allowable for at least the same reason.

The Office Action rejected claims 57-60 and 63 under 35 U.S.C. § 103(a) as being unpatentable over Jukan in view of Melaku et al., US Patent Publication No. 2003/0074443 (hereinafter “Melaku”).

Melaku describes rerouting traffic to a different path based on a change in QoS requirements. (Melaku, Paragraph 0056.) “If the user decides to change WoS requirements in the midst of a session, the LMQB [Last Mile QoS Broker] dynamically updates the database [of the LMQB] and re-allocates new resources and establishes a path that meets the requested quality of service.” (Melaku, Paragraph 0056.)

The combination of Jukan and Melaku does not describe “receiving a request to change a service provisioned with a communication path established in a wavelength division multiplexing optical network at one of a plurality of service levels to a different one of said plurality of service levels, wherein different wavelengths on at least certain links of said optical network qualifying for different ones of said plurality of service levels forms a different service level topology for each of said plurality of service levels for each access node of said optical network; selecting a path and a wavelength on said path using a database that stores, for each of the plurality of service levels, a representation of every available path from a source node of said communication path to other access nodes in said optical network, wherein each path is a series of two or more nodes connected by links having a set of one or more wavelengths at the same service level; causing allocation of the selected wavelength in the series of nodes of the selected path to form a new communication path; and transitioning said service to the new communication path. Rather, the combination describes a node that only has knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links.

Accordingly, the combination of Jukan and Melaku does not describe what Applicants require in claim 57. Claims 58-63 are dependent upon claim 57 and are therefore allowable for at least the same reason.

The Office Action rejected claims 64-67 and 70 under 35 U.S.C. § 103(a) as being unpatentable over Jukan in view of Melaku as applied to claims 57-60, and further in view of Freeman.

The combination of Jukan and Melaku does not describe “responsive to receiving a request to change a service provisioned with a communication path established in a wavelength division multiplexing optical network at one of a plurality of service levels to a different one of said plurality of service levels, selecting a path and a wavelength on said path using a database that stores, for each of the plurality of service levels, a representation of every available path from a source node of said communication path to other access nodes in said optical network, wherein different wavelengths on at least certain links of said optical network qualifying for different ones of said plurality of service levels forms a different service level topology for each of said plurality of service levels for each access node of said optical network, wherein each path is a series of two or more nodes connected by links having a set of one or more wavelengths at the same service level; causing allocation of the selected wavelength in the series of nodes of the selected path to form a new communication path; and transitioning said service to the new communication path.” Rather, the combination describes a node that only has knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links.

Accordingly, the combination of Jukan and Melaku does not describe what Applicants require in claim 64. Claims 65-70 are dependent upon claim 64 and are therefore allowable for at least the same reason.

The Office Action rejected claims 71-73 and 70 under 35 U.S.C. § 103(a) as being unpatentable over Golmie in view of Sengupta and Date, “An Introduction to Database Systems” (hereinafter “Date”).

Date describes database systems. “A database systems is basically a computerized recording system.” (Date, Page 5.) “The hardware [of a database] consists of the secondary storage volumes – typically moving head disks...” (Date, Page 7.)

The combination of Golmie, Sengupta, and Date does not describe “a service level connectivity database for an access node of a wave division multiplexing optical network, wherein each link of said optical network includes a set of zero or more lamdas for each of a plurality of service levels, each of said plurality of service levels includes a set of zero or more possible end to end paths comprised of a series of one or more links that include one or more lamdas of that service level, said service level connectivity database including, for each of the possible end to end paths that end with said access node, data representing, the series of links of that path; and the lamdas of that path. Rather, the combination describes a node that only has knowledge of its local service level information including what links are immediately adjacent to the node, QoS for those links only, and availability of lambdas only for those links.

Accordingly, the combination of Golmie, Sengupta, and Date does not describe what Applicants require in claim 71. Claims 72 and 74-75 are dependent upon claim 71 and are therefore allowable for at least the same reason.


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Respectfully submitted,

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